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TO AVIAN BOTULISM: UPDATE**

**UNITED STATES DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE
Special Scientific Report – Wildlife No. 243**

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By Sonoma S. Wilson
Louis N. Locke



**UNITED STATES DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE**

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Bibliography of References to Avian Botulism: Update

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This bibliography, first compiled in 1970 (Allen and Wilson 1977) and published in 1977 in response to many requests for information on avian botulism, has been updated to include the literature published through 1980.

In general, only articles dealing primarily with the avian disease are included, as opposed to those concerned with the various aspects of the biology of *Clostridium botulinum*, either type C or E. A few exceptions, such as Bengtson's report of the first isolation and description of the type C organism, are included for their historical interest. Progress reports and other administrative documents not available for distribution on request are excluded, as are most textbook accounts, which are generally summaries of work published elsewhere.

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Although the authors attempted to list every important reference, they make no claim to complete coverage of the published literature. The authors will be grateful to users of the bibliography who call attention to errors or omissions.

Wayne I. Jensen (Retired)

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Director, National Wildlife Health Laboratory

- Alcorn, J. R. 1944. Botulism in the Carson Sink, Nevada. *Condor* 46(6):300.
- Allen, J. P., and S. S. Wilson. 1977. A bibliography of references to avian botulism. U.S. Fish Wildl. Serv. Spec. Sci. Rep. - Wildl. 204. 6 pp.
- Anonymous. 1931. Botulism and ducks. (Editorial). *J. Am. Med. Assoc.* 96(1):864-865.
- Anonymous. 1934. The Franklin gull tragedy. (Editorial). *The Winnipeg Free Press*, 27 July.
- Anonymous. 1979. Waterfowl killer. *Outdoor Life*, March:118.
- Austin, O. L., and O. L. Austin, Jr. 1931. Food Poisoning in shore birds. *Auk* 48(2):195-197.
- Bach, R. N. 1943. Botulism. *N. D. Outdoors* 6(6):6-7.
- Baljer, G., S. Chorgherr, R. Hoffmann, H. Knoppler, and H. Wiedemann. 1974. [Type C botulinum toxin as a cause of bird mortality in a lake in upper Bavaria.] *Tierarztl. Praxis* 2 Heft 2:191-197.
- Barton [Batson], H. C. 1941. Western duck sickness. *Game Breeder and Sportsman* Pt. 1, June:104-105, 109, 118-119; Pt. 2, July:122-124, 126, 129.
- Batson, H. C. 1940. Western duck sickness (botulism) in South Dakota. Pages 6-7 and 11-16 in *South Dakota Conservation Digest*.
- Bell, J. F., G. W. Sciple, and A. A. Hubert. 1956. A microenvironment concept of the epizootology of avian botulism. *J. Wildl. Manage.* 19(3):352-357.
- Bengtson, I. A. 1922. Preliminary note on a toxin-pro-

- ducing anaerobe isolated from the larvae of *Lucilia caesar*. Public Health Rep. 37(1):164-170.
- Bengtson, I. A. 1922. Separation of toxic and non-toxic cells from cultures of an anaerobe isolated from the larvae of the green fly. Public Health Rep. 37(2):2252-2256.
- Bengtson, I. A. 1923. A toxin-producing anaerobe isolated principally from fly larvae. Public Health Rep. 38(8):340-344.
- Bengtson, I. A. 1924. Studies on organisms concerned as causative factors in botulism. U.S. Public Health Serv. Publ. Hyg. Lab. Bull. 136. 101 pp.
- Bergeland, M. E. 1964. Botulism in wild fowl. Minn. Farm Home Sci. 22(2):3.
- Bergeland, M. E., H. W. Moon, G. A. M. Sharman, and R. L. Green. 1962. Pheasant death loss investigation at Fort Peck, Montana game farm—summer 1962. Montana Fish and Game Department. 6 pp. (Mimeo)
- Bierer, B. W. 1974. Botulism in western waterfowl. Page 80 in History of Animal Plagues of North America. Reproduced by U.S. Department of Agriculture, Washington, D.C.
- Bishopp, F. C. 1923. Limberneck of fowls produced by fly larvae. J. Parasitol. 9(3):170-173.
- Blaker, D. 1967. An outbreak of botulism among waterbirds. Ostrich 38(2):144-147.
- Blandford, T. B., and T. A. Roberts. 1970. An outbreak of botulism in broiler chickens. Vet. Rec. 87(9):258-261.
- Blandford, T. B., T. A. Roberts, and W. L. G. Ashton. 1969. Losses from botulism in mallard duck and other waterfowl. Vet. Rec. 85(2):541-543.
- Boever, W. J. 1976. Diseases of galliformes. Including their diagnosis and treatment. World Pheasant Assoc. J. 11:80-88.
- Bond, R. M. 1946. The peregrine population of western North America. Condor 48(3):101-116.
- Borland, E. D. 1976. Outbreak of botulism in reared East Anglian pheasants. Vet. Rec. 99(11):220-221.
- Borland, E. D., C. J. Moryson, and G. R. Smith. 1977. Avian botulism and the high prevalence of *Clostridium botulinum* in the Norfolk Broads. Vet. Rec. 100(6):106-109.
- Boroff, D. A., and J. R. Reilly. 1958. Active immunization of pheasants and ducks against *Clostridium botulinum* type C intoxication. Bacteriol. Proc. 58:78-79. (Abstract)
- Boroff, D. A., and J. R. Reilly. 1959. Studies of the toxin of *Clostridium botulinum*. V. Prophylactic immunization of pheasants and ducks against avian botulism. J. Bacteriol. 77(2):142-146.
- Boroff, D. A., and J. R. Reilly. 1960. Immunization of pheasants against the toxin of *Clostridium botulinum* type C. Bacteriol. Proc. 60:89-90. (Abstract)
- Boroff, D. A., and J. R. Reilly. 1962. Studies of the toxin of *Clostridium botulinum*. VI. Botulism among pheasants and quail, mode of transmission, and degree of resistance offered by immunization. Int. Arch. Allergy Appl. Immunol. 20:306-313.
- Bossenmaier, E. F. 1950. Waterfowl investigations at Whitewater Lake, Manitoba, 1950. Can. Dep. Mines Resour., Spec. Sci. Rep. — Wildl. 8. 256 pp.
- Bossenmaier, E. F. 1959. Waterfowl sickness diagnosis in Minnesota, North Dakota, and Manitoba. J. Wildl. Manage. 23(1):113-115.
- Bossenmaier, E. F., T. A. Olsen, M. E. Rueger, and W. H. Marshall. 1954. Some field and laboratory aspects of duck sickness at Whitewater Lake, Manitoba. Trans. N. Am. Wildl. Conf. 19:163-175.
- Bott, T. L., J. S. Deffner, E. M. Foster, and E. McCoy. 1964. Ecology of *Clostridium botulinum* in the Great Lakes. Pages 221-224 in Botulism: proceedings of a symposium. U.S. Public Health Serv. Publ. No. 999-FP-1.
- Brada, W., J. Langenegger, and C. H. Langenegger. 1971. [Botulism in poultry in the State of Rio de Janeiro, Brazil.] Pesqui. Agropecu. Bras. Ser. Vet. 6:27-32.
- Brown, A. Graham. 1974. Botulism and Murrumbidgee Valley encephalitis. R. Aust. Ornithol. Union 20:1.
- California Fish and Game Commission. 1913. Wild duck epidemic at Tulare Lake. Am. Field 80(15):350.
- Cheatum, E. L., J. R. Reilly, and S. C. Fordham, Jr. 1957. Botulism in game farm pheasants. Trans. N. Am. Wildl. Conf. 22:169-179.
- Chief, Bureau Biological Survey. 1911. Epidemic among wild ducks at Great Salt Lake. Page 6 in Fiscal Report of the Chief, Bureau of Biological Survey. U.S. Department of Agriculture, Washington, D.C.
- Christiansen, M. 1949. Sygdomme hos vildt levende fugle. Dan Ornithol. Foren. Tidsskr. 43:189-215.
- Ciccarelli, A., D. N. Whaley, L. M. McCroskey, Domingo F. Gimenez, V. R. Dowell, Jr., and C. L. Hatheway. 1977. Cultural and physiological characteristics of *Clostridium botulinum* type G and the susceptibility of certain animals to its toxin. Appl. Environ. Microbiol. 34(6):843-848.
- Clarke, F. C. 1913. Preliminary report upon the disease occurring among ducks of the southern San Joaquin Valley during fall of 1913. Condor 15(6):214-226.
- Coale, H. K. 1911. Enormous death rate among waterfowl near Salt Lake City, Utah, fall of 1910. Auk 28(2):274.
- Coburn, D. R. 1942. Concerning the nature of type C botulinum toxin fractions. Science 95(2467):389-390.
- Coburn, D. R., and E. R. Quortrup. 1938. The distribution of botulinus toxin in duck sickness area. Trans. N. Am. Wildl. Conf. 3:869-876.
- Coburn, D. R., and E. R. Quortrup. 1938. Atypical botulism in turkeys. J. Am. Vet. Med. Assoc. 93(6):385-387.
- Coburn, D. R., and E. R. Quortrup. 1939. Recent findings in relation to the control of botulism in waterfowl. Trans. N. Am. Wildl. Conf. 4:359-363.
- Cohen, G. M., and A. L. Pates. 1973. Resistance of

- roosters and vultures to type A botulinal toxin. Annu. Meet. Am. Soc. Microbiol. 73:93.
- Cohen, G. M., A. L. Pates, D. M. Easton, and M. G. Peterson. 1969. Vulture and rooster resistance to botulinum toxin. Am. Zool. 9(3):584. (Abstract)
- Compton, R. 1954. Hospital for ducks. Western Sportsman, Dec. 1954.
- Cooch, F. G. 1949. Whitewater Lake die-off. U.S. Dep. Inter. and Can. Dep. Mines and Resour., Spec. Sci. Rep. — Wildl. 2:66–68.
- Cooch, F. G. 1964. A preliminary study of the survival value of a functional salt gland in prairie anatidae. Auk 81(3):380–393.
- Crisley, F. D., V. R. Dowell, and R. Angelotti. 1968. Avian botulism in a mixed population of resident ducks in an urban river setting. Bull. Wildl. Dis. Assoc. 4(3): 70–77.
- Dadot, F. 1945. Botulisme des canards. Rec. de Med. Vet. 121:177–180.
- Davis, C. E. 1917. Death among waterfowl at Salton Sea, California. Calif. Fish Game 4(1):50.
- Deem, A. W., and F. Thorp. 1939. Toxic algae in Colorado. J. Am. Vet. Med. Assoc. 95(752):542–544.
- Dell'orbo, S. 1947. Caso di botulismo in un pollo. Zootrofissi 2:107.
- Demaree, H. A., Jr. 1968. Pheasant botulism and toxoid treatment investigation on the Jasper Pulaski State Fish and Game area in 1968. Report of Indiana State Fish and Game Department, n.p.
- Dendy, J. S. 1944. The fate of animals in stream drift when carried into lakes. Ecol. Monogr. 14(3):333–357.
- Dickson, E. C. 1917. Botulism, a case of limberneck in chickens. J. Am. Vet. Med. Assoc. 50[New Ser. 3(5)]: 612–613.
- Dinter, Z. 1955. Zur Activan gegen das Botulinus-toxin C. Nord. Veterinaarmed. 7:1056–1062.
- Dinter, Z., and K. E. Kull. 1950. Botulismus bien new in Schweden. Nord. Veterinaarmed. 2:286–301.
- Dinter, Z., and K. E. Kull. 1954. Über einen Ausbruch des botulismus bei frasanenkuken. Nord. Veterinaarmed. 6:866–872.
- Dinter, Z., and K. E. Kull. 1955. Botulism in pheasant chicks. Vet. Bull. 25:276.
- Doyle, L. P. 1923. Limberneck in chickens. J. Am. Vet. Med. Assoc. 63(6):745–758.
- Doutre, M. P. 1967. [Type C botulism in a dove (*Streptopelia roseogrisea bornuensis*) from Ferlo (Senegal).] Rev. Elev. Med. Vet. Pays Trop. 20(4):601–604.
- Doutre, M. P., and J. Chambron. 1966. Le botulisme de ruminants et des equides au Senegal. Rev. Elev. Med. Vet. Pays Trop. 19(4):495–510.
- Duncan, R. M., and W. I. Jensen. 1976. A relationship between avian carcasses and living invertebrates in the epizootiology of avian botulism. J. Wildl. Dis. 12: 116–126.
- Durant, A. J. 1940. Limberneck (botulism) in fowl. Univ. Mo. Coll. Agric., Agric. Exp. Stn. Circ. 207. 6 pp.
- Egyed, M. N., U. Klopfer, T. A. Nobel, A. Shlosberg, A. Tadmor, I. Zuckerman, and Y. Avidar. 1978. Mass outbreaks of botulism in ruminants associated with ingestion of feed containing poultry waste. II. Experimental investigations. Refuah Vet. 35:100–104.
- Egyed, M. N., A. Shlosberg, U. Klopfer, T. A. Nobel, and E. Mayer. 1978. Mass outbreaks of botulism in ruminants associated with ingestion of feed containing poultry waste. I. Clinical and laboratory investigations. Refuah Vet. 35:93–99.
- Enright, C. 1971. A review of research on type C botulism among waterbirds. Bureau of Sport Fisheries and Wildlife and Colorado Cooperative Wildlife Research Unit. iii + 22 pp.
- Estola, T., and H. Stenberg. 1963. [On the occurrence of Clostridia in domestic animals and animal products.] Nord. Veterinaarmed. 15:35–47.
- Fallis, A. M. 1943. Suspected botulism in wild ducks in Ontario. Can. Field-Nat. 57(2/3):51–52.
- Farleigh, E. A. 1949. Botulism in wild birds. Pages 101–102 in Yearbook Inst. Inspector of Stock, New South Wales, Australia.
- Fay, L. D. 1966. Type E botulism in Great Lake birds. Bull. Wildl. Dis. Assoc. 2(3):65 (Abstract)
- Fay, L. D. 1966. Type E botulism in Great Lake water birds. Trans. N. Am. Wildl. Nat. Resour. Conf. 31: 139–149.
- Fay, L. D. 1966. Botulism: Cause of bird mortality in the Great Lakes. Mich. Dep. Conserv. Res. Dev. Rep. 106. 5 pp.
- Fay, L. D., O. W. Kaufman, and L. A. Ryel. 1965. Mass mortality of water birds in Lake Michigan, 1963–1964. Univ. Mich. Great Lakes Res. Publ. 13:36–46.
- Fay, L. D., O. W. Kaufman, and L. A. Ryel. 1965. Field observations and laboratory investigations concerning recent Lake Michigan bird mortalities. Mich. Dep. Conserv. Res. Dev. Rep. 25. 14 pp.
- Fish, N. A., W. R. Mitchell, and D. A. Barnum. 1967. A report of a natural outbreak of botulism in pheasants. Can. Vet. J. 8(1):10–16.
- Fisher, A. K. 1893. Report on birds (Death Valley Expedition). U.S. Bur. Biol. Serv., N. Am. Fauna 7:7–158.
- Foreyt, W. J., and F. R. Abinanti. 1980. Maggot-associated type C botulism in game farm pheasants. J. Am. Vet. Med. Assoc. 177(9):827–828.
- Forrester, D. J., K. C. Wenner, F. H. White, E. C. Greiner, W. R. Marion, J. E. Thul, and G. A. Berkoff. 1980. An epizootic of avian botulism in a phosphate mine settling pond in northern Florida. J. Wildl. Dis. 16(3):323–327.
- Foster, E. M., and H. Sugiyama. 1967. Recent developments in botulism research. Health Lab. Sci. 4(4): 193–198.
- Fredine, G., and J. F. Bell. 1938. Ducks get sick, too. Minn. Conserv. 63:16–17, 24, 34.
- Fried, L. A. 1941. Duck sickness in Minnesota. Conserv. Volunteer 1(5):48–51.

- Fuller, T. L., B. W. Anderson, and R. L. Timken. 1968. Analysis of a bird die-off as an indicator of marsh utilization. *Proc. S. D. Acad. Sci.* 47:149-155.
- Gardiner, M. R. 1967. Clostridial infections in poultry in western Australia. *Aust. Vet. J.* 43(9):359-360.
- Geiger, J. C., E. C. Dickson, and K. F. Meyer. 1922. The epidemiology of botulism. U.S. Public Health Serv. Bull. 127. 119 pp.
- Generoso, J. C., and F. San Augustin. 1940. Botulism in ducks along Laguna de Bay. *Phillipp. J. Anim. Ind.* 7:419-430.
- Giltner, L. T., and J. F. Couch. 1930. Western duck sickness and botulism. *Science* 72(1878):660.
- Glebova, I. Ya., and A. V. Masyukov. 1963. [Etiology of neuro-toxemia of ducks.] *Veterinariya* 9(1):40-42.
- Glover, F. A. 1970. Waterfowl of Colorado. Colo. Div. Game Fish Parks, Dep. Nat. Resour. State Printing Code GFP-G-1-27-70. 31 pp.
- Gomez, A. 1947. Botulismo (in poultry). *Crias y Cult.* 1(8/9):15-16.
- Graham, J. M. 1978. Inhibition of *Clostridium botulinum* type C by bacteria isolated from mud. *J. Appl. Bacteriol.* 45(2):205-211.
- Graham, J. M., and G. R. Smith. 1977. Observations on the possible invasiveness of *Clostridium botulinum* for waterfowl. *Res. Vet. Sci.* 22(3):343-347.
- Graham, J. M., G. R. Smith, E. D. Borland, and J. W. MacDonald. 1978. Avian botulism in winter and spring and the stability of *Clostridium botulinum* type C toxin. *Vet. Rec.* 102(2):40-41.
- Graham, R. 1946. Botulism in wild ducks. *N. Am. Vet.* 27(11):710.
- Graham, R., and H. Schwarze. 1920. Avian botulism: Type A or limberneck. *J. Infect. Dis.* 28:317-322.
- Graham, R., R. D. Glasgow, and E. Barger. 1922. The housefly, *Musca domestica*, as a possible disseminator of *Bacillus botulinus* and botulism toxin. Abstracts of Bacteriology, 1917-1925. Superseded by *Biol. Abstr.* 6(1):1-20.
- Graham, R., and I. B. Boughton. 1923. *Clostridium botulinum* type C: A pathogenic anaerobe associated with a limberneck-like disease in chickens and ducks. *Univ. Ill. Agric. Exp. Stn. Bull.* 246. 34 pp.
- Graham, R., and I. B. Boughton. 1924. *Clostridium botulinum* type C associated with a limberneck-like disease in chickens and ducks. *J. Am. Vet. Med. Assoc.* New Ser. 17(17):723-727.
- Graikoski, J. T. 1966. Distribution of *Clostridium botulinum* type E in the ecosystem of the Great Lakes (U.S.A.), and related bird mortalities. *Bull. Wildl. Dis. Assoc.* 2(3):65. (Abstract)
- Green, R. G. 1931. Diseases in relation to game cycles. *Trans. N. Am. Game Conf.* 18:109-117.
- Green, R. G. 1933. Disease as a factor in wildlife management. *Minn. Wildl. Conserv.* 3(14):15.
- Green, R. G. 1938. The occurrence of botulism in waterfowl in western Minnesota. *Minn. Wildl. Dis. Invest.* 3:128-132.
- Gross, W. G., and L. D. Smith. 1971. Experimental botulism in gallinaceous birds. *Avian Dis.* 15(4):716-721.
- Grubb, W. B. 1964. Avian botulism in Western Australia. *Aust. J. Exp. Biol. Med. Sci.* 42(1):17-26.
- Gunderson, M. F. 1932. The occurrence of lead poisoning and western duck sickness in Minnesota. *Fin Feathers Fur* 106:8-9, 23.
- Gunderson, M. F. 1933. Presence of *Clostridium botulinum* in livers of birds not affected with botulism. *Proc. Soc. Exp. Biol. Med.* 30:747-750.
- Gunderson, M. F. 1935. Insects as carriers of *Clostridium botulinum*. *J. Bacteriol.* 30(3):333.
- Gunderson, M. F. 1938. The protective action of egg-albumen when administered orally with *Clostridium botulinum* (type C) culture to pigeons. *J. Bacteriol.* 36:301-302.
- Gunning, O. V. 1950. Losses in geese, ducks, and poultry caused by a toxin in the gut contents which resembled the toxin produced by the anaerobe *Clostridium botulinum*. *Br. Vet. J.* 106(1):81-82.
- Gunnison, J. B., and G. E. Coleman. 1932. *Clostridium botulinum* type C associated with western duck sickness. *J. Infect. Dis.* 51(3):542-551.
- Haagsma, J. 1965. Ziekten bij de nerts (*Mustela vison*) in Nederland. *Diergeneesk. Memo.* 12:259.
- Haagsma, J. 1973. The etiology and epidemiology of botulism in waterfowl in the Netherlands. *Hydrobiol. Bull.* 7:96-105.
- Haagsma, J. 1973. [Etiology and epidemiology of botulism in waterfowl in the Netherlands, with special reference to thermal pollution and public health.] *Bronder-Offset B. V., Rotterdam.* 205 pp.
- Haagsma, J. 1974. Etiology and epidemiology of botulism in waterfowl in the Netherlands. *Tijdschr. Diergeneesk.* 99(8):434-442.
- Haagsma, J. 1974. [An outbreak of botulism in broiler chickens.] *Tijdschr. Diergeneesk.* 99(19):979-990.
- Haagsma, J. 1974. An outbreak of botulism in broiler chickens. *Tijdschr. Diergeneesk.* 99(20):1069-1070.
- Haagsma, J. 1979. Clostridial diseases in Europe (with appendices on botulism in U.S.A.). Pages 225-294 in *CRC Handbook on Zoonoses. Section A: Bacterial, Rickettsial and mycotic diseases. Volume I.* J. H. Steele, Editor-in-chief. CRC Press, Boca Raton, Florida.
- Haagsma, J., and E. A. ter Laak. 1977. [Contribution to the aetiology and epidemiology of botulism in broiler chickens.] *Tijdschr. Diergeneesk.* 102(7):429-436.
- Haagsma, J., E. A. ter Laak, A. Osinga, and P. Feenstra. 1977. [Botulism among cattle in loose housing following use of litter from a broiler farm.] *Tijdschr. Diergeneesk.* 102(5):330-332.
- Haagsma, J., H. J. Over, Th. Smith, and J. Hoekstra. 1971. Een onderzoek naar aanleiding van het optreden van botulismus bij watervogels in 1970 in Nederland. *Tijdschr. Diergeneesk.* 96:1072.

- Haagsma, J., H. J. Over, T. Smith, and J. Hoekstra. 1972. Botulism in waterfowl in the Netherlands in 1970. *Neth. J. Vet. Sci.* 5(1):12-33.
- Hammond, M. C. 1950. Some observations on sex ratios of ducks contracting botulism in North Dakota. *J. Wildl. Manage.* 14(2):209-214.
- Hariharan, H. 1976. Type C avian botulism with reference to the role of bacteriophages. *Diss. Abstr. Int.* 37B(3):1136.
- Hariharan, H., and W. R. Mitchell. 1976. Observations on bacteriophages of *Clostridium botulinum* type C isolates from different sources and the role of certain phages in toxigenicity. *Appl. Environ. Microbiol.* 32(1):145-158.
- Hariharan, H., and W. R. Mitchell. 1977. Type C botulism: the agent, host spectrum and environment. *Vet. Bull.* 47(2):95-103.
- Harrigan, K. E. 1980. Botulism in broiler chickens. *Australian Vet. J.* 56:603-605.
- Harrison, Greg H. 1974. *Clostridium botulinum* type C infection on a game fowl farm. Pages 221-224 in *American Association of Zoo Veterinarians, Annual Proceedings*, Atlanta, Georgia, November 3-7.
- Hart, G.H. 1920. Clinical and case reports. Botulism of chickens. *J. Am. Vet. Med. Assoc. New Ser.* 10(1):75-77.
- Hay, C. M. E., H. N. Van Der Made, and P. C. Knoetze. 1973. Isolation of *Clostridium botulinum* type C from an outbreak of botulism in wild geese. *J. S. Afr. Vet. Assoc.* 44(1):53-56.
- Hayes, F. A., and W. R. Davidson. 1978. Waterfowl diseases. Status, contributing factors, and control. Pages 48-49 in *Third International Waterfowl Symposium*, New Orleans, Louisiana, January 27-29.
- Hazen, E. L. 1942. Differential characteristics of two strains of *Clostridium botulinum* type E: Action of toxin in chickens. *Proc. Soc. Exp. Biol. Med.* 50: 112-114.
- Hentschike, J., and S. Raethel. 1977. [Botulism in water birds on Berlin ponds and lakes.] *Tierarztl. Umsch.* 32(4):168, 170-172.
- Herman, C. M. 1954. Wildlife diseases. *Southeast. Vet.* 6(1):10-12.
- Herman, C. M. 1955. Diseases of birds. Pages 450-467 in *Albert Wolfson, ed. Recent advances in avian biology*, University of Illinois Press, Urbana.
- Herman, C. M. 1964. Significance of bird losses on Lake Michigan during November and December, 1963. *Univ. Mich. Great Lakes Res. Div. Publ.* 11:84-87.
- Herman, C. M. 1969. The impact of disease on wildlife populations. *BioScience* 19(4):321-325.
- Hill, H. M., and L. M. Graham. 1961. Waterfowl botulism outbreak in San Jacinto Valley, Riverside County, California. *Calif. Fish Game* 47(1):113-114.
- Hobmaier, M. 1930. Duck disease caused by the poison of the *Bacillus botulinus*. *Calif. Fish Game* 16(4): 285-286.
- Hobmaier, M. 1930. Duck disease caused by the toxin of *Clostridium botulinum* type C. *Proc. Soc. Exp. Biol. Med.* 28:339-340.
- Hobmaier, M. 1932. Conditions and control of botulism (duck sickness) in waterfowl. *Calif. Fish Game* 18(1): 5-21.
- Hunter, B. F. 1966. New technique detects botulism in wildlife. *Calif. Dep. Fish Game* 14(36):345-353.
- Hunter, B. F. 1970. Ecology of waterfowl botulism toxin production. *Trans. N. Am. Wildl. Nat. Resour. Conf.* 35:64-72.
- Hunter, B. F. 1970. Waterfowl botulism in California—1969. *Calif. Fish Game* 56(3):207-208.
- Hunter, B. F. 1977. Controlling waterfowl disease. *Outdoor Calif.* 38(5):21-24.
- Hunter, B. F., and W. E. Clark. 1971. Waterfowl botulism management. *Resour. Agency Calif., Dep. Fish Game, Wildl. Manage. Leaflet* 14. 11 pp.
- Hunter, B. F., W. E. Clark, P. J. Perkins, and P. R. Coleman. 1970. Applied botulism research including management recommendations, a progress report. *California Department of Fish and Game, Wildlife Management Branch*. 87 pp.
- Hunter, B. F., and M. N. Rosen. 1967. Detection of *Clostridium botulinum* type C cells by the fluorescent antibody technique. *Avian Dis.* 11(3):345-353.
- Iida, H. 1970. Activation of *Clostridium botulinum* toxin by trypsin, types A, B, C, D, E, F. Pages 336-340 in *M. Herzberg, ed. Proceedings of the 1st U.S.-Japan Conference on Toxic Microorganisms*.
- Itoh, T., K. Saito, S. Sakai, and K. Tabuchi. 1978. [Experimental botulism in wild ducks and toxin production of *Clostridium botulinum* type C.] *Bull. Azabu Vet. Coll.* 3(1):75-81.
- Jensen, W. I. 1963. Populations of aquatic insects in relation to botulism at the Bear River Bird Refuge, Box Elder County, Utah. *Proc. Annu. Meet. Utah Mosq. Abatement Assoc.* 16:13-14.
- Jensen, W. I. 1981. Evaluation of coproexamination as a diagnostic test for avian botulism. *J. Wildl. Dis.* 17(2):171-176.
- Jensen, W. I., and J. P. Allen. 1960. A possible relationship between aquatic invertebrates and avian botulism. *Trans. N. Am. Wildl. Nat. Resour. Conf.* 25:171-180.
- Jensen, W. I., and R. M. Duncan. 1980. The susceptibility of the mallard duck (*Anas platyrhynchos*) to *Clostridium botulinum* C₂ toxin. *Jpn. J. Med. Sci. Biol.* 33(2):81-86.
- Jensen, W. I., and R. B. Gritman. 1966. An adjuvant effect between *Clostridium botulinum* types C and E, in the mallard duck (*Anas platyrhynchos*). Pages 407-413 in *Symposium on botulism*, Chapman and Hall, Ltd., London.
- Jensen, W. I., and J. M. Micuda. 1970. The effect of malathion on the susceptibility of the mallard duck (*Anas platyrhynchos*) to *Clostridium botulinum* type C toxin. Pages 372-375 in *M. Herzberg, ed. Proceedings*

- of the 1st U.S.-Japan Conference on Toxic Microorganisms.
- Jensen, W. L., and C. S. Williams. 1964. Botulism and fowl cholera. *Waterfowl Tomorrow*. Pages 333-341 in 1964 Yearbook. U.S. Department of the Interior, Washington, D.C.
- Jorek, Norbert. 1977. [Habitat management concepts worked out at the sewage-farm project at Muenster.] *Angew. Ornithol.* 5(2):57-108.
- Kalmbach, E. R. 1930. Western duck sickness produced experimentally. *Science* 72(1878):658-660.
- Kalmbach, E. R. 1932. Progress in western duck sickness studies. *Science* 75(1932):57-58.
- Kalmbach, E. R. 1932. Duck sickness, not contagious. *Am. Game*, May-June. n.p.
- Kalmbach, E. R. 1935. Botulism as a factor in the decrease of western waterfowl. Pages 140-143 in U.S. Department of Agriculture Yearbook of Agriculture. Washington, D.C.
- Kalmbach, E. R. 1935. Will botulism become a world-wide hazard to wildfowl? *J. Am. Vet. Med. Assoc. New Ser.* 40(2):183-187.
- Kalmbach, E. R. 1938. Botulism, a recurring hazard to waterfowl, with notes on recent outbreaks in the U.S., Canada, and Australia. U.S. Bur. Biol. Survey, Wildl. Leaflet 120. 8 pp.
- Kalmbach, E. R. 1939. Botulism in western waterfowl. Page 80 in Bert W. Bierer. *History of animal plagues of North America*. U.S. Department of Agriculture, Washington, D.C.
- Kalmbach, E. R. 1939. American vultures and the toxin of *Clostridium botulinum*. *J. Am. Vet. Med. Assoc. New Ser.* 47(3):187-191.
- Kalmbach, E. R. 1968. Type C botulism among wild birds - a historical sketch. U.S. Fish Wildl. Serv., Spec. Sci. Rep. - Wildl. 110. 8 pp.
- Kalmbach, E. R., and M. F. Gunderson. 1934. Western duck sickness, a form of botulism. U.S. Dep. Agric., Tech. Bull. 411. 81 pp.
- Kaufman, O. W., and E. M. Creel. 1967. Experimentally induced immunity in gulls to type E botulism. *Am. J. Vet. Res.* 28(127):1857-1862.
- Kaufman, O. W., and L. D. Fay. 1964. *Clostridium botulinum* type E toxin in tissues of dead loons and gulls. Mich. State Univ. Exp. Stn. Q. Bull. 47:236-242.
- Kaufman, O. W., R. H. Monheimer, and H. M. Solomon. 1966. Field and laboratory studies on type E botulism in gulls. *Bull. Wildl. Dis. Assoc.* 2(3):65. (Abstract)
- Kaufman, O. W., H. M. Solomon, and R. H. Monheimer. 1967. Experimentally induced type E botulism in gulls hatched under natural conditions and reared in captivity. Pages 400-406 in *Proceedings of the 5th International Symposium on Food and Microbiology - Botulism 1966*. Chapman and Hall, Ltd., London.
- Kennedy, C. H. 1940. Botulism in chickens. *Vet. Med.* 35(4):250-251.
- Keymer, I. F., G. R. Smith, T. A. Roberts, S. I. Heaney, and D. J. Hibberd. 1972. Botulism as a factor in waterfowl mortality at St. James' Park, London. *Vet. Rec.* 90(5):111-114.
- Kinsey, A. 1954. Botulism strikes down snow geese. *Okla. Game Fish News* 10(12):10.
- Kohler, B., M. Feiler, F. Friedrichs, and E. Bottcher. 1977. [Outbreak of botulism among water fowl.] *Monatsh. Veterinaarmed.* 32(5):178-182.
- Krull, J. N. 1970. Aquatic plant-macroinvertebrate associations and waterfowl. *J. Wildl. Manage.* 34(4):707-718.
- Krummes, W. T. 1950. Botulism control and treatment. USDI, Fish and Wildl. Serv., Branch of Wildl. Refuges. Wildl. Manage. Ser., Circ. No. 2 (Revised).
- Laak, E. A. ter. 1980. Botulismus bij watervogels. *Tijdschr. Diergeneesk.* 105(17):719-723.
- Lakin, H. W., E. R. Quortrup, and N. Hotchkiss. 1943. The relation of selenium to western duck sickness. *Auk* 61(3):415-420.
- Lee, V. H., S. Vadlamudi, and R. P. Hanson. 1962. Blow fly larvae as a source of botulinum toxin for game farm pheasants. *J. Wildl. Manage.* 26(4):411-413.
- Linsdale, J. M. 1938. Observations on waterbirds in California. *Calif. Fish Game* 24(1):2-43.
- Lloyd, C. S., G. J. Thomas, J. W. MacDonald, E. D. Borland, K. Standring, and J. L. Smart. 1976. Wild bird mortality caused by botulism in Britain, 1975. *Biol. Conserv.* 10(2):119-129.
- Locke, L. N., and G. E. Bagley. 1965. DDT in loons. Pages 13-14 in *Effects of pesticides on fish and wildlife: 1964 research findings of the Fish and Wildlife Service*. U.S. Fish Wildl. Serv., Circ. 226.
- Louis, A. F. 1941. Duck sickness in Minnesota: botulism in western lakes. *Conserv. Volunteer* 1(5):48-51.
- Luthgen, W. 1972. [Losses in waterfowl on stagnant water due to type C botulism.] Pages 89-93 in *Diseases of zoo animals. XIVth International Symposium, 1972*. Wroclaw. Akad.-Verlag, Berlin.
- Luthgen, W. 1972. [A modification of the mouse test to demonstrate type C botulism in birds.] *Berl. Muench. Tieraerztl. Wochenschr.* 85 Heft 6:107-110.
- Luthgen, W. 1977. [Botulism in poultry.] *Prakt. Tierarztl.* 58(5):332, 334, 337-338.
- MacDonald, J. W., and K. T. Standring. 1978. An outbreak of botulism in gulls on the Firth of Forth, Scotland. *Biol. Conserv.* 14:149-155.
- Madsen, D. H. 1929. Fighting the duck disease at Great Salt Lake. *Bull. Am. Game Prot. Assoc.* 2(1). n.p.
- Madsen, D. H. 1929. The tragedy of western waterfowl. *Field Stream* 33(12):30-31, 108-110.
- Manuwal, D. A. 1967. Observations on a localized duck sickness in the Delta Marsh (Manitoba), summer 1964. *Wilson Bull.* 79(2):219-222.
- Martinovich, D., E. Carter, D. A. Woodhouse, and I. P. McCausland. 1972. An outbreak of botulism in wild waterfowl in New Zealand. *N.Z. Vet. J.* 20(5):61-65.
- Matveev, K. I., and N. D. Konstantinova. 1974. [The

- role played by migrating birds in the distribution of the botulism agent.] *Gig. Sanit.* 12:91-92.
- Mays, A. S. 1941. Observations on duck diseases at Tulare Basin, 1940. *Calif. Fish Game* 27(3):154-163.
- McCreary, K. 1970. War waged against devastating duck destroyer. *Ducks Unlimited*, Spring:7, 22-23.
- McCroskey, L. M., and V. R. Dowell, Jr. 1973. Investigation of avian botulism outbreaks in the U.S.A. *Abstr. Annu. Meet. Am. Soc. Microbiol.* 73:12.
- McLachlan, J. J., and L. G. Newton. 1952. Botulism in poultry. *Queensl. Agric. J.* 74(2):87-92.
- McLean, D. D. 1946. Duck disease at Tulare Lake. *Calif. Fish Game* 32(2):71-80.
- McLean, D. D. 1950. Bird banding at Tulare Lake. *Calif. Fish Game* 36(2):75-117.
- McLeod, E. R. 1950. Duck botulism. *Sci. Monthly* 71(5):302-308.
- McMahan, C. A. 1968. Migrant maladies. *Tex. Parks Wildl.*, Aug.:12-15.
- Milbradt, H. 1976. [Large-scale mortality in waterfowl caused by *Clostridium botulinum* type C toxin.] *Dtsch. Tierärztl. Wochenschr.* 83(7):331-332.
- Miyazaki, S., and G. Sakaguchi. 1978. Experimental botulism in chickens: The cecum as the site of production and absorption of botulinum toxin. *Jpn. J. Med. Sci. Biol.* 31(1):1-16.
- Miyazaki, S., and G. Sakaguchi. 1979. Pathogenesis of chicken botulism. *Jpn. J. Med. Sci. Biol.* 32:129.
- Monheimer, R. H. 1968. The relationship of Lake Michigan waterbird mortalities to natural occurring *Clostridium botulinum* type E toxin. *Bull. Wildl. Dis. Assoc.* 4(3):81-85.
- Morgan, B. B. 1944. Bird mortality. *Passenger Pigeon* 6(2):27-34.
- Moulton, D. W., W. I. Jensen, and J. B. Low. 1976. Avian botulism epizootiology on sewage oxidation ponds in Utah. *J. Wildl. Manage.* 40(4):735-742.
- Muller, J. 1967. [Botulism in wild ducks diagnosed for the first time in Denmark.] *J. Medlemsbl. Dan Dyr-laegeforen.* 50:887-890.
- Munro, D. A. 1950. Review of waterfowl conditions in Canada. *Trans. N. Am. Wildl. Conf.* 15:94-98.
- Munro, J. A. 1927. The waterfowl sickness at Lake Newell, Alberta, 1925-1926. *Can. Field-Nat.* 41(4):77-84.
- Nelson, E. W. 1927. Vanishing migratory birds. *Saturday Evening Post* 199(34):12-13, 92, 94, 97.
- Nelson, N. F. 1953. Evaluation of botulism control methods. *Utah Fish and Game*. Federal Aid Project 29-R-7, Progress Report.
- Nicol, G. 1946. Botulism in ducks and geese. *Aust. Poultry World* 17(8):19.
- Nicol, G. 1946. Botulism in ducks and geese. *Victoria Dep. Agric. J.* 44:59-60.
- Nilehn, P. O., and A. Johannsen. 1965. An outbreak of avian botulism. *Nord. Veterinaarmed.* 17(12):685-692.
- Notermans, S., J. Dufrenne, and S. Kozaki. 1980. Experimental botulism in Pekin ducks. *Avian Dis.* 24(3):658-664.
- Notermans, S., J. Dufrenne, M. Van Schothorst. 1979. Recovery of *Clostridium botulinum* from mud samples incubated at different temperatures. *Eur. J. Appl. Microbiol. Biotechnol.* 6(4):403-407.
- Oglesby, C. V., and F. A. Glover. 1954. Body temperature of botulistic pintails. *Condor* 56(3):162-163.
- Ohishi, I., G. Sakaguchi, H. Riemann, D. Behymer, and B. Hurvell. 1979. Antibodies to *Clostridium botulinum* toxins in free-living birds and mammals. *J. Wildl. Dis.* 15(1):3-9.
- O'Roke, E. C. 1933. Some important problems in game bird pathology. *Trans. Am. Game Conf.* 19:424-431.
- Osieck, E. R., and C. S. Roselaar. 1972. A find of marsh sandpiper *Tringa stagnatilis* in the Netherlands. *Limosa* 45(3/4):135-138.
- Page, R. K., and O. J. Fletcher. 1975. An outbreak of type C botulism in three-week-old broilers. *Avian Dis.* 19(1):192-195.
- Palmer, C. C., and H. R. Baker. 1922. Botulism (Limberneck) in swans. *Ohio State Univ. Vet. Alumni Q.* 10:93-94.
- Palmer, C. C., and H. R. Baker. 1923. A case of botulism in ducks and swans. *Poultry Sci.* 2(1):75-77.
- Palmer, C. M. 1939. Disease—a serious wildlife problem. *Va. Wildl.* 2(11):2-3.
- Parrish, J. M., and B. F. Hunter. 1969. Waterfowl botulism in the southern San Joaquin Valley, 1967-1968. *Calif. Fish Game* 55(4):265-272.
- Pates, A. L., B. L. Davidson, and K. F. Teilford. 1967. The presence of a substance in culture serum which neutralizes type C. *Clostridium botulinum* toxin. *Proceedings of the Southeast Branch of the American Society for Microbiologists.* n.p.
- Pederson, H. O. 1953. Botulism. *Nord. Veterinaarmed.* 5:700-703.
- Pesce, F. A. de, and H. F. Sardi. 1965. [Avian botulism, first outbreak in our country, caused by contaminated feed.] *Rev. Med. Vet. (B. Aires)* 46(3):151-151.
- Pesce, F. A. de, and H. F. Sardi. 1966. Avian botulism, first case compared in the country. *Gac. (B. Aires)* 28(192):317-318.
- Pesce, F. A. de, and H. F. Sardi. 1967. Botulismo aviar, primer caso comprobado en la Republica Argentina. *Bull. Off. int. Epiz.* 67:1479-1491.
- Phillips, J. C., and F. C. Lincoln. 1930. Pages 150-161 in *American Waterfowl*. Houghton Mifflin Co., Boston, Mass.
- Plummer, C. C. 1913. That duck disease. *Am. Field* 80(21):422.
- Poole, D. A. 1952. Current studies of botulism in ducks. *Trans. N. Am. Wildl. Conf.* 17:160-167.
- Pullar, E. M. 1933. Limberneck (botulism) in ducks. *Aust. Vet. J.* 9(1):26-30.
- Pullar, E. M. 1934. Enzootic botulism amongst wild birds. *Aust. Vet. J.* 10(4):128-135.

- Quortrup, E. R. 1946. An improved method of testing for botulinus toxin by the use of penicillin. *J. Am. Vet. Med. Assoc.* 109:214-215.
- Quortrup, E. R., and A. L. Holt. 1941. Detection of potential botulinus-toxin producing areas in western duck marshes, with suggestions for control. *J. Bacteriol.* 41(3):363-372.
- Quortrup, E. R., and J. E. Shillinger. 1941. 3000 wild bird autopsies on western lake areas. *J. Am. Vet. Med. Assoc.* 99(776):382-387.
- Quortrup, E. R., and R. L. Sudheimer. 1942. Research notes on botulism in western marsh areas, with recommendations for control. *Trans. N. Am. Wildl. Conf.* 7:284-293.
- Quortrup, E. R., and R. L. Sudheimer. 1943. Some ecological relations of *Pseudomonas aeruginosa* to *Clostridium botulinum* type C. *J. Bacteriol.* 45(6):551-554.
- Quortrup, E. R., and R. L. Sudheimer. 1943. Detection of botulinus toxin in the blood stream of wild ducks. *J. Am. Vet. Med. Assoc.* 102(793):264-266.
- Rawson, D. S., and J. E. Moore. 1944. The saline lakes of Saskatchewan. *Can. J. Res. Sect. D Zool. Sci.* 22: 141-201.
- Reid, J. T. 1957. Duck sickness. *Nat. Hist.* 66(9):475-481.
- Reilly, J. R., and D. A. Boroff. 1959. Study of the toxin of *Clostridium botulinum*. VI. Single injection of immunization of pheasants against avian botulism. *Bacteriol. Proc.* 59:88. (Abstract)
- Reilly, J. R., and D. A. Boroff. 1961. The toxoid of *Clostridium botulinum* as a means of immunizing pheasants against avian botulism. *N. Y. Fish Game J.* 8(1):57-60.
- Reilly, J. R., and D. A. Boroff. 1967. Botulism in a tidal estuary in New Jersey. *Bull. Wildl. Dis. Assoc.* 3(1): 26-29.
- Richardson, J. H., G. L. Brewer, Jr., and L. V. Holde-
man. 1965. Type C *Clostridium botulinum* intoxication in domestic ducks in Georgia. *J. Am. Vet. Med. Assoc.* 146(7):737.
- Roberts, T. A., and A. M. Collings. 1973. An outbreak of type C botulism in broiler chickens. *Avian Dis.* 17(3): 650-658.
- Roberts, T. A., and A. M. Gibson. 1979. The relevance of *Clostridium botulinum* type C in public health and food processing. *J. Food Technol.* 14:211-226.
- Roberts, T. A., I. F. Keymer, E. D. Borland, and G. R. Smith. 1972. Botulism in birds and mammals in Great Britain. *Vet. Rec.* 91(1):11-12.
- Roberts, T. A., A. I. Thomas, and R. J. Gilbert. 1973. A third outbreak of type C botulism in broiler chickens. *Vet. Rec.* 92(5):107-109.
- Robinson, E. M. 1929. Notes on a few outbreaks of botulism in domesticated animals and birds. 15th Annu. Rep. Dir. Vet. Serv., Union S. Afr. Dep. Agric. Pt. 1: 11-117.
- Rose, A. L. 1935. Enzootic botulism amongst wild birds. *Aust. Vet. J.* 10:175-177.
- Rosen, M. N. 1938. Botulism. *Wasmann J. Biol.* 2:3-32.
- Rosen, M. N. 1953. A study of diseases of wildlife species in California. *Pittman-Robertson Q.* 13(1):17-18.
- Rosen, M. N. 1959. Immunization of pheasants with botulinum toxoid. *Calif. Fish Game* 45(4):343-350.
- Rosen, M. N. 1965. Control of waterfowl botulism. *Calif. Fish Game, Game Manage. Leaflet* 10. 6 pp.
- Rosen, M. N. 1966. Botulism in birds other than waterfowl. *Bull. Wildl. Dis. Assoc.* 2(3):65.
- Rosen, M. N. 1971. Botulism. Pages 100-117 in John W. Davis, Roy Anderson, Lars Karstad, and Daniel O. Trainer, eds. *Infectious and parasitic diseases of wild birds*. Iowa State University Press, Ames.
- Rosen, M. N., and A. L. Bischoff. 1953. A new approach toward botulism control. *Trans. N. Am. Wildl. Conf.* 18:191-199.
- Rosen, M. N., and J. B. Cowan. 1953. Winter botulism: Sequel to a severe summer outbreak. *Proc. Annu. Conf. West. Assoc. State Game Fish Comm.* 33:189-193.
- Rosen, M. N., and W. J. Mathey, Jr. 1955. Some new pheasant diseases in California. *Trans. N. Am. Wildl. Conf.* 20:220-228.
- Rossi, P., and J. Berujon. 1950. Botulisme du canards, son traitement. *Bull. Acad. Vet. Fr.* 23:365-369.
- Rowan, W. 1927. Banding Franklin gulls in Alberta. *Wilson Bull.* 39(1):44-49.
- Sakaguchi, G. 1978. Intradigestive tract toxin production of botulism in infants and broilers. *Jpn. J. Bacteriol.* 33(5):673-680.
- Saraiva, D. 1978. [Botulism of type C in fowls in Rio Grande do Sul, Brazil.] *Rev. Cent. Cienc. Rurais* 8(2): 153-159.
- Saraiva, D., and C. Piloni. 1980. [Outbreak of C type botulism in broiler fowls in Santa Catarina State, Brazil.] *Rev. Cent. Cienc. Rurais* 10(2):197.
- Schettler, C. H. 1979. [Botulism in broiler fowl in North West Germany (*Clostridium botulinum* type C toxin).] *Berl. Muench. Tieraerztl. Wochenschr.* 92(3):50-57.
- Scholtens, R. G., and D. B. Coohon. 1964. Botulism in animals and man, with special reference to type E *Clostridium botulinum*. *Am. Vet. Med. Assoc. Sci. Proc.* 101:224-230.
- Schwartz, L. K., and G. Smart. 1963. Control of botulism in wildfowl. *J. Am. Vet. Med. Assoc.* 143(2):163.
- Sciple, G. W. 1953. Avian botulism: Information on earlier research. *U.S. Fish Wildl. Serv., Spec. Sci. Rep. - Wildl.* 23. 13 pp.
- Shave, H. J. 1970. Progressive pathologic signs of botulism in pheasants. *J. Wildl. Dis.* 6(4):402-403.
- Shaw, P. A. 1929. Duck disease studies: I. Blood analysis in diseased birds. *Proc. Soc. Exp. Biol. Med.* 27:6-7.
- Shaw, P. A. 1929. Duck disease studies: II. Feed of single and mixed salts. *Proc. Soc. Exp. Biol. Med.* 27:120-122.
- Shaw, P. A. 1929. Duck disease studies: III. Salt content of soils in disease and non-disease areas. *Proc. Soc. Exp. Biol. Med.* 27:275-278.
- Shaw, P. A. 1930. Recent progress in duck disease studies. *J. Am. Vet. Med. Assoc. New Ser.* 30(5):561-568.

- Shaw, R. M., and G. S. Simpson. 1936. *Clostridium botulinum*, type C, in relation to duck sickness in Alberta. J. Bacteriol. 32(1):79-88.
- Shillinger, J. E. 1933. Disease as a factor in wildlife administration. Outdoor Am. 11(4):10-12.
- Shillinger, J. E., and L. C. Morley. 1942. Diseases of upland game birds. U.S. Fish Wildl. Serv., Circ. 21. 32 pp.
- Skamser, L. M. 1946. Botulism in turkeys. Turkey World 21(11):86-87.
- Smart, J. L., and T. A. Roberts. 1977. An outbreak of type C botulism in broiler chickens. Vet. Rec. 100(18):378-380.
- Smith, D. A. 1958. An economic evaluation of selected treatment for avian botulism in waterfowl on Utah marshes. Proc. Annu. Conf. West. Assoc. State Game Fish Comm. 38:220-225.
- Smith, G. A. 1976. Botulism in captive birds. Avic. Mag. 82(3):172-174.
- Smith, G. R. 1976. Botulism in waterfowl. Wildfowl 27:129-138.
- Smith, G. R. 1978. Botulism, waterfowl and mud. Br. Vet. J. 134(5):407-411.
- Smith, G. R., J. M. Hime, I. F. Keymer, J. M. Graham, P. J. S. Olney, and M. R. Brambell. 1975. Botulism in captive birds fed commercially-bred maggots. Vet. Rec. 97:204-205.
- Smith, G. R., and R. A. Milligan. 1979. *Clostridium botulinum* in soil on the site of the former Metropolitan (Caledonian) Cattle Market, London, England, U.K. J. Hyg. 83(2):237-242.
- Smith, G. R., and J. Moryson. 1975. *Clostridium botulinum* in the lakes and waterways of London. J. Hyg. 75(3):371-379.
- Smith, G. R., and C. J. Moryson. 1977. A comparison of the distribution of *Clostridium botulinum* in soil and in lake mud. J. Hyg. 78(1):39-41.
- Smith, G. R., R. A. Milligan, and C. J. Moryson. 1978. *Clostridium botulinum* in aquatic environments in Great Britain and Ireland. J. Hyg. 80(3):431-438.
- Smith, G. R., C. J. Moryson, and J. G. Walmsley. 1977. The low prevalence of *Clostridium botulinum* in the lakes, marshes and waterways of the Camarque (France). J. Hyg. 78(1):33-37.
- Smith, L. D. 1977. Botulism. The organism, its toxins, the disease. Charles C. Thomas, Springfield, Illinois. 236 pp.
- Smith, L. P. 1979. The effect of weather on the incidence of botulism (*Clostridium botulinum*) in water fowl. Agric. Meteorol. 20(6):483-488.
- Soldati, G., M. Pavesi, and N. Benimeo. 1973. [Outbreaks of botulism in wild ducks.] Nuova Vet. 49(6):331-334.
- Soper, J. D. 1934. A waterfowl reconnaissance of Wood Buffalo Park. Trans. Am. Game Conf. 20:258-266.
- Sperry, C. C. 1947. Botulism control by water manipulation. Trans. N. Am. Wildl. Conf. 12:228-233.
- Staples, K. J. 1969. Problems in raising ducks. J. Agric. South. Aust. 72(6):202-207.
- Steele, J. H. 1977. The zoonoses in the South Pacific and their public health significance. Int. J. Zoonoses 4(1):1-20.
- Steiniger, F. 1962. *Salmonella* sp. and *Clostridium botulinum* in waterfowl and sea birds. Annu. Rep. Wildfowl Trust 13:149-152.
- Stout, I. J., and G. W. Cornwell. 1976. Nonhunting mortality of fledged North American waterfowl. J. Wildl. Manage. 40(4):688-690.
- Stabbs, E. L. 1951. Botulism in ducks or duck sickness. Univ. Pa. Bull. Vet. Ext. Q. 124:10-17.
- Sutherland, D. N. 1955. Botulism in farm animals. Queensl. Agric. J. 81(2):97-102.
- Szyfres, B., H. Trench, and D. Abaracon. 1948. Intoxication botulinique de canards. Off. Int. de Epizoot. B. 29:431-437.
- Tinker, F. A. 1958. Avian botulism: The battle at Bear River. Audubon Mag. 60(3):116-119, 140; 60(4):174-177; 60(5):224-227.
- Tjaberg, T. B., L. Rossero, and S. Hauge. 1967. The sensitivity of chickens of *Clostridium botulinum* types A, B, C, and E. Nord. Veterinaarmed. 19(11):540-545.
- Toth, S. 1974. Botulism (western duck disease) and its effect on waterfowl in New Jersey. New Jersey Outdoors, July/Aug.:12-14.
- Trimm, L. 1951. Ducks alive. Audubon Mag. 53(5):302-305, 324.
- True, G. H., Jr. 1940. Duck disease. Calif. Conserv. 5(6):1-3.
- Twomey, A. C., and S. J. Twomey. 1936. Selenium and duck sickness. Science 83(2159):470-471.
- Twomey, A. C., S. J. Twomey, and L. R. Wilson. 1939. Selenium and duck sickness. Science 90(2346):572-573.
- U.S. Fish and Wildlife Service. 1961. Wildlife diseases and parasites. Page 18 in Wildlife research progress fiscal year 1960. U.S. Government Printing Office, Washington, D.C.
- U.S. Fish and Wildlife Service. 1962. Wildlife diseases and parasites. Page 22 in Wildlife research progress 1961. U.S. Government Printing Office, Washington, D.C.
- U.S. Fish and Wildlife Service. 1963. Wildlife diseases and parasites. Pages 48-49 in Wildlife research problems programs progress 1962. U.S. Government Printing Office, Washington, D.C.
- U.S. Fish and Wildlife Service. 1964. Wildlife diseases and parasites. Pages 51-52 in Wildlife research problems programs progress 1963. U.S. Government Printing Office, Washington, D.C.
- U.S. Fish and Wildlife Service. 1965. Wildlife diseases and parasites. Pages 52-55 in Wildlife research problems programs progress 1964. U.S. Government Printing Office, Washington, D.C.
- U.S. Fish and Wildlife Service. 1966. Wildlife diseases and parasites. Pages 56-59 in Wildlife research prob-

- lems programs progress 1965. U.S. Government Printing Office, Washington, D.C.
- U.S. Fish and Wildlife Service. 1967. Wildlife diseases and parasites. Pages 67-69 in *Wildlife research problems programs progress 1966*. U.S. Government Printing Office, Washington, D.C.
- U.S. Fish and Wildlife Service. 1969. Wildlife diseases and parasites. Pages 60-62 in *Wildlife research problems programs progress 1967*. U.S. Government Printing Office, Washington, D.C.
- U.S. Fish and Wildlife Service. 1970. Wildlife diseases and parasitism. Pages 61-65 in *Wildlife research problems programs progress 1968*. U.S. Government Printing Office, Washington, D.C.
- U.S. Fish and Wildlife Service. 1971. Wildlife diseases and parasitism. Pages 54-56 in *Wildlife research problems programs progress 1969*. U.S. Government Printing Office, Washington, D.C.
- U.S. Fish and Wildlife Service. 1972. Wildlife diseases and parasitism. Pages 50-52 in *Wildlife research problems programs progress 1970*. U.S. Government Printing Office, Washington, D.C.
- U.S. Fish and Wildlife Service. 1972. Wildlife diseases and parasitism. Pages 58-62 in *Wildlife research problems programs progress 1971*. U.S. Government Printing Office, Washington, D.C.
- U.S. Fish and Wildlife Service. 1974. Wildlife studies. Page 85 in *Sport fishery and wildlife research 1972*. U.S. Government Printing Office, Washington, D.C.
- U.S. Fish and Wildlife Service. 1975. Migratory birds. Pages 107-108 in V. T. Harris and P. H. Eschmeyer, eds. *Sport fishery and wildlife research 1973-74*. U.S. Government Printing Office, Washington, D.C.
- U.S. Fish and Wildlife Service. 1978. Migratory birds. Pages 81-82 in T. G. Scott et al., eds. *Sport fishery and wildlife research 1975-76*. U.S. Government Printing Office, Washington, D.C.
- U.S. Fish and Wildlife Service. 1978. Migratory birds. Pages 88-94 in T. G. Scott et al., eds. *Fisheries and wildlife research 1977*. U.S. Government Printing Office, Washington, D.C.
- U.S. Fish and Wildlife Service. 1979. Migratory birds. Pages 101-103 in T. G. Scott et al., eds. *Fisheries and wildlife research 1978*. U.S. Government Printing Office, Washington, D.C.
- U.S. Fish and Wildlife Service. 1980. Migratory birds. Pages 117-119 in T. G. Scott and P. H. Eschmeyer, eds. *Fisheries and wildlife research 1979*. U.S. Government Printing Office, Washington, D.C.
- Utah Fish and Game Commission. 1950. Botulism strikes again. *Utah Fish Game Bull.* 9(4):4.
- Vadlamundi, S., H. V. Lee, and R. P. Hanson. 1959. Case report - Botulism type C outbreak on a pheasant game farm. *Avian Dis.* 3(3):344-350.
- Van den Akker, J. B., and V. T. Wilson. 1949. Twenty years of bird banding at Bear River Migratory Bird Refuge, Utah. *J. Wildl. Manage.* 13(4):359-376.
- Van Heerden, J. 1974. Botulism in the Orange Free State Goldfields. *Ostrich* 45(3):182-184.
- Van Roekel, H. 1929. Wild duck disease. *Calif. Fish Game* 15(1):11-12.
- Von Krosigk, E. 1978. [Europa nature preserve in the pond region of Ismaning (suburb of Munich, Bavaria): 32nd report: 1974-1976.] *Anz. Ornithol. Ges. Bayern* 17(1-2):37-62.
- Wetmore, A. 1915. Mortality among waterfowl around Great Salt Lake, Utah. U.S. Dep. Agric. Bull. 217. 10 pp.
- Wetmore, A. 1918. The duck sickness in Utah. U.S. Dep. Agric. Bull. 672. 25 pp.
- Wetmore, A. 1921. Wild ducks and duck foods of the Bear River marshes. Utah. U.S. Dep. Agric. Bull. 936. 20 pp.
- White, C. 1963. botulism and myiasis as mortality factors in falcons. *Condor* 65(5):442-443.
- Wilkens, S. D., and R. A. Dutcher. 1920. Limberneck in poultry. *J. Am. Vet. Med. Assoc.* 57 [New Ser. 10] (6):653-685.
- Willis, A. T., A. Baillie, A. C. Baird-Parker, R. J. Gilbert, B. C. Hobbs, G. Hobbs, and T. A. Roberts. 1971. Report on the incidence of *Clostridium botulinum* in dressed poultry. *Vet. Rec.* 89:668-669.
- Woodall, P. F. 1979. Suspected botulism poisoning of waterfowl at Seven Mile Lagoon, South-east Queensland. *Sunbird* 10(1):17-20.
- World Wildlife Fund. 1973. [Mass death of birds in Spain from bacteriological poisoning "botulism."] *Ornithol. Mitt.* 25(11):247.
- Zimmerman, F. R. 1946. Western duck sickness (botulism) in the Green Bay area. *Wis. Conserv. Bull.* 11(12): 3-7.

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